

## THE CLAIMS

What is claimed is:

- 5                    1.        A method of producing a substrate for conducting epitaxial growth thereon, which comprises:
- obtaining a substantially relaxed epitaxial base layer on an auxiliary substrate;
- transferring at least a portion of the epitaxial base layer onto a carrier substrate to provide a base substrate; and
- 10                    increasing the thickness of the transferred epitaxial base layer portion on the carrier substrate by epitaxial growth to form an epitaxial base layer thereon while maintaining a high degree of thermodynamic and crystallographic stability of the grown epitaxial base layer.
- 15                    2.        The method of claim 1, wherein the epitaxial base layer is made of a first material, and its thickness is about 0.1  $\mu\text{m}$  to about 5  $\mu\text{m}$ .
3.        The method of claim 1, wherein the relaxed epitaxial base layer is lattice-mismatched with the auxiliary substrate.
- 20                    4.        The method of claim 1, wherein at least a portion of the epitaxial base layer is transferred to the carrier substrate by:
- implanting atomic species in the base epitaxial layer to form weakened zone to define the portion to be transferred;
- 25                    bonding the implanted epitaxial base layer with the carrier substrate; and
- detaching the bonded portion of the epitaxial base layer at the weakened zone to transfer it to the carrier substrate.
- 30                    5.        The method of claim 1, wherein the carrier substrate is made of silicon, silicon dioxide, fused silica, oxidised silicon, germanium, gallium nitride, indium phosphide, or gallium arsenide.
6.        The method of claim 1, further comprising thermally treating the base substrate after transferring the portion of the epitaxial base layer.

7. The method of claim 1, further comprising conducting an operation on a surface of the transferred portion of the epitaxial base layer for improving surface conditions of the transferred epitaxial base layer portion prior to the epitaxial growth thereon.

5 8. The method of claim 1, wherein the epitaxial base layer portion that is transferred has a first dislocation density, and the epitaxial base layer that is grown on the carrier substrate has a dislocation density that is lower than the first dislocation density.

10 9. The method of claim 1, wherein the transfer of the epitaxial base layer portion from the auxiliary substrate to the carrier substrate is conducted in a manner to provide a dislocation density in the transferred portion that is lower than that of the epitaxial base layer on the auxiliary substrate.

15 10. The method of claim 1, wherein the further grown portion of the epitaxial base layer comprises silicon germanium.

20 11. The method of claim 1, which further comprises transferring a first portion of the grown portion on the carrier substrate to another substrate to form a composite structure.

25 12. The method of claim 11, wherein the grown portion has a thickness that is sufficient to allow an additional transfer of part of the grown portion to remain after the transfer of the first portion to the another substrate, and the method further comprises transferring a second portion of the grown portion to a further substrate.

13. The method of claim 12, which further comprises at least one of re-claiming and planarizing the second portion prior to the transfer thereof.

30 14. The method of claim 1, which further comprises growing at least one second epitaxial layer on the further grown portion that is associated with the carrier substrate.

15. The method of claim 14, wherein the at least one second epitaxial layer is of silicon.

16. The method of claim 14, wherein the at least one second epitaxial layer has a thickness of about 10 nm to about 20 nm.

5 17. The method of claim 14, wherein the transferred epitaxial base layer portion is made of a first material, and the method further comprises growing an additional epitaxial base layer of the first material on the second epitaxial layer.

10 18. The method of claim 17, wherein the second epitaxial layer is made of a different material from the first material, and the additional epitaxial base layer is grown to provide a repeating structure with layers of materials arranged in an alternating sequence.

15 19. The method of claim 14, which further comprises transferring a combination of at least a portion of the epitaxial base layer together with at least a portion of the second epitaxial layer to another substrate.

20. The method of claim 19, further comprising finishing a surface of the transferred combination to enhance its surface properties.